Name: ______________________________________ **Date:** ____________________

Algebra 1B DBQ:
Should we send people to Mars in the near future?

You or your partner or group will complete the following:

- Read and annotate two of the articles on www.mars-one.com under the Mission tab,"Mission Feasibility" and "Risks and Challenges", and one under the FAQ tab, "Is This Ethical?".
- Watch and take notes on the video, "A One-Way Ticket to Mars: What They are Not Telling Us 2016" available at: https://www.youtube.com/watch?v=DLsQfQ1hgE8
- Examine and complete the chart, "Earth/Mars Facts and Computations".
- Prepare to make a decision by completing the Buckets Chart and Decision Outline.
- Make a decision and either: a) neatly write or type a one-page response to your decision, using support from the articles, video, and the chart or b) create a newscast that broadcasts the result of your decision, using support from the articles, video and chart.

Timeline:

Day	Area of Focus	Targeted Outcome
Day 1	Read and annotate the articles on www.mars-one.com.	- Read and annotate articles. Fill out the guided sheet. - Be prepared to discuss annotations with your group.
Day 2	Watch and take guided notes on video.	- See multiple perspectives, including people from the Mars-One group and NASA. - Fill out guided notes chart.
Day 3	Examine the chart and answer questions.	- See the realities of the project and life on Mars through math computation.
Day 4	Decision-Making: Decide whether we should send people to Mars and choose your product.	- Fill out the Buckets Chart and Decision Outline. - Write either a one-page response or create a newscast to broadcast the response.
Day 5	Present products	Due in class: Neatly written or typed final papers OR Present newscast to the class.

Name: ______________________________________ **Date:** ____________________

Document 1: Mars-One.Com Annotations

Read and annotate the three articles on www.mars-one.com. Then, write some bulleted responses/notes here.

Mission Feasibility
● ______________________________
● ______________________________
● ______________________________
● ______________________________
● ______________________________
● ______________________________
Risk and Challenges
● ______________________________
● ______________________________
● ______________________________
● ______________________________
● ______________________________
● ______________________________
Is This Ethical?
● ______________________________

- ____

- ____

- ____

- ____

- ____

Document 1: Mars-One.Com

Mission Feasibility

A number of design decisions make Mars One's plan feasible:

Permanent settlement

The Mars One crews consist of people that want to settle on Mars. Absence of a return mission reduces the mission infrastructure radically. No return vehicle, return propellant or the systems to produce the propellant locally are required. Permanent settlement also reduces the required technology development; vehicles that can take off from Mars and return to Earth are currently unavailable and untested. Since the vehicle returning to Earth and the accompanying systems are mission critical for a return mission, they will also require backups adding to the infrastructure that needs to be delivered to Mars. More importantly, to attain a somewhat acceptable risk level, the return mission would need to be tested in a complete unmanned return trip before the first crew even departs the Earth. Even after a full test of the return system is successfully performed, the risk for a crew that will ride the first return rocket would be very high: 126 rockets launched from Earth since 1990 failed to deliver their payloads in the correct orbit.

Permanent settlement also solved the challenge of the astronauts entering into Earth's atmosphere after having spent about two years in reduced or zero gravity environments.

Use of In-Situ resources:

Mars has resources that can be used for a sustainable settlement. Water is present in the soil and can be made available to the settlement for hygiene, drinking, and farming. It is also the source of oxygen generated through electrolysis. Nitrogen and argon in the Martian atmosphere can be mined to be the inert part of the atmosphere inside the habitat. Martian soil will cover the outpost to block cosmic radiation. Carbon dioxide can be taken from the atmosphere if the plants take in more than the humans expel.

The systems to mine water from the soil and to mine nitrogen, argon, and carbon dioxide from the atmosphere have never been tested in space. Mars is however not space because there is gravity and a thin atmosphere. Additionally, the processes are all more than 100 years old. The water can be collected from the soil by breaking up the soil with a drill and harvesting the resulting debris. Argon and Nitrogen can be collected from the atmosphere by removing the carbon dioxide through a phase change.

Solar panels:

The Sun is a reliable, robust, and plentiful energy source. Using solar panels is the best choice for Mars One since it takes away the requirement to develop and launch a nuclear reactor, thereby saving time and money

while avoiding the risks and concerns of the use of a nuclear power source.
Thin film solar (photovoltaic) panels will power the Mars One settlement. These are less efficient than those more commonly used in aerospace, but have the advantage of being extremely light, and are thus easily transportable. The first settlement will install approximately 3000 square meters of power generating surface area.

Existing technology:

No new major developments or inventions are needed to make the mission plan a reality. Established suppliers can build each stage of Mars One mission plan. While most of the components required are not immediately available with the exact specifications, there is no need for radical modifications to the current component designs.

Every effort was made to design the mission with as little complexity as possible. The choice to send permanent settlers removes the need for a heavy lift launch vehicle, which does not currently exist. Permanent settlement makes the landing module small enough to land with current technology. A pressurized rover will not be sent to Mars until large enough rockets exists. No water recycling in the transit habitat will be present because the trip to Mars takes only 210 days. Instead, all required water is stored in tanks that also function as radiation shielding. Storage of waste that is not easily recycled is available in the settlement until more technology is available.

International yet apolitical:

Mars One is a non-governmental company and is apolitical in its function. Suppliers are chosen on a balance of price and quality, not through political or national preferences.

The astronaut selection process will engage tens, even hundreds of thousands of applicants from different countries worldwide. Each team selected for settlement on Mars will be comprised of four people, each from a different nation on Earth. From start to finish, from Earth to Mars, Mars One is dedicated to an international, intergenerational effort to take the human species to its next home planet. In addition, Mars One has no internal technology development; this is done completely by consultants that specialize in the field. Furthermore, Mars One does not have its own hardware development centers that can push the use of their own technologies.

Risk and Challenges

Mars One has developed a mission to establish a human settlement on Mars built entirely upon existing technology. While the integration of systems proven in prior missions does greatly improve the chance of success, it by no means eliminates the risk or challenge of such an incredible endeavor. Sending humans to Mars remains a phenomenal undertaking by all standards and, as such, presents very real risks and challenges.

United States President John F. Kennedy said in his famous Rice Moon speech "We choose to go to the Moon, not because it is easy, but because it is hard".

Mars One takes on the challenge of establishing a settlement on Mars with the same frame of mind, knowing all great endeavors, especially space exploration, incorporate risk of lost time, resources, ... and sometimes lives. Venturing to Mars is no exception.

The challenge is to identify the risks in every step of the ten year mission, from astronaut selection through training, from launch to living on Mars. Mars One has incorporated into its mission plan a detailed risk analysis protocol, built by highly experienced individuals, some of them with experience at NASA and the ESA. Ever evolving, ever improving, Mars One is constantly working to reduce the risk of delay and failure at every level.

For example, the Mars lander will be tested eight times prior to the landing of the first crew, using identical vehicles. As is standard in the aerospace industry, every component will be selected for its simplicity, durability, and capacity to be repaired using the facilities that are available to the astronauts on Mars.

An important aspect of risk management is for quality information to be shared between suppliers and made readily available to all parties. In the case of the Mars One mission, this includes sponsors, investors, aerospace suppliers, and of course, the astronauts themselves. Because the mission is ultimately funded and supported by the global audience, Mars One also desires for the general public to have a sense of what the risks are and how Mars One is working to mitigate them.

Mars One identifies two major risk categories: the loss of human life and cost overruns.

Human Life
Human space exploration is dangerous at all levels. After more than fifty years of humans traveling from Earth to space, the risk of space flight is similar to that of climbing Mount Everest.
Mars is an unforgiving environment where a small mistake or accident can result in large failure, injury, and death. Every component must work perfectly. Every system (and its backup) must function without fail or human life is at risk.
With advances in technology, shared experience between space agencies, what was once a one-shot endeavor becomes routine and space travel does become more viable.
Cost overruns
Cost overruns are also not uncommon in large projects in any arena. The risk for cost overrun in the Mars One mission is reduced by using existing technologies, and by the fact that about 66% of the cost is associated with launch and landing--both of which are well understood and proven variables.
The proposed Mars One budget includes a large safety margin to take into account significant mission failures as well as smaller but costly failures of components on Mars.
Mars One has developed a detailed risk analysis profile which guides both its internal technical development as well as the relationships it builds with its aerospace suppliers. This risk analysis profile will continue to evolve and improve over the years prior to the first humans walking on the planet Mars.

Is This Ethical?

We want to emphasize a number of issues:

- A 'one way' trip (or, in other words: emigration) to Mars is currently the only way we can get people on Mars within the next 20 years. This in no way excludes the possibility of a return flight at some point in the future. It is likely that technological progress will make this less complex down the line, not to mention the fact that once the planet is inhabited, it will be that much easier to build the returning rocket there. This means that in time it could be possible for astronauts to return to Earth at some point in the future, should they want to do so;
- Mars One will take every possible precaution to ensure the journey to Mars will be as safe as can be;
- All those emigrating will do so because they choose to. They will receive extensive preparatory training so that they fully know what to expect. Astronauts that have passed the selection process can always choose not to join the mission at any time, and at any point during preparations. Back-up teams will be ready to replace any crew member that drops out, even at the very last minute.
- Our first and foremost priority is to offer the people on Mars as high a quality of life as we can, which encompasses the following:

1. Unlimited access to email and other communication channels to keep in touch with friends and family back on Earth;
2. As many exploration and experimentation opportunities as are available;
3. The means to build and develop as much as they can themselves. They can work on the expansion of their Mars base and use the new rooms as they wish.

- Our second priority is to have at least four people emigrate every two years, so that the community continues to grow.

Despite all of the above, it still sounds rather extreme nowadays to only offer a one way trip, but it bears mentioning that thousands of Europeans agreed to do just that – they took all they owned and moved to Australia, for example. That agreement did not come with a return ticket. The boat went back, but that did not mean they could afford to go with it. Maybe they could buy another ticket after saving up for a few years – just like our astronauts could build a rocket after some time.
The emigrants of the 60s could never have imagined that, 30 years later, they would be able to fly back to Europe for a small amount. Perhaps, at some point, a trip to Mars will become just as commonplace.
Considering all of the above, we do indeed think it is ethically conscientious to allow people to emigrate to Mars.

Name: ______________________________ **Date:** ______________

Document 2: Video: *"A One-Way Ticket to Mars: What They are Not Telling Us 2016"*

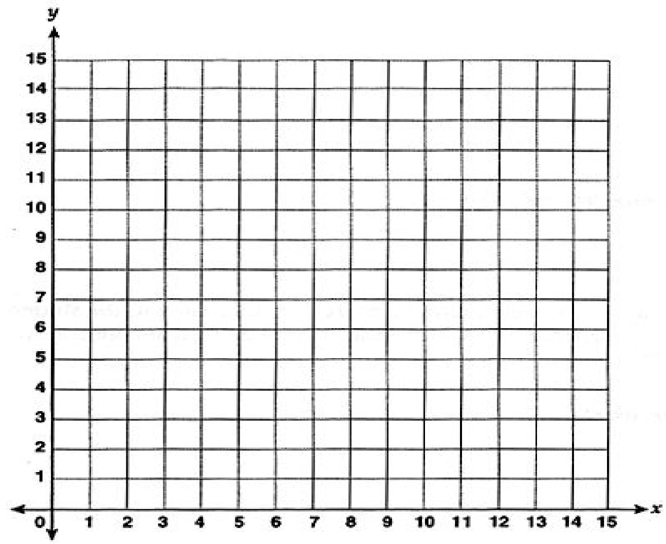
Facts - *Include ONLY solid facts, focusing especially those that involve numbers.* ____________________ ____________________ ____________________ ____________________ ____________________ ____________________ ____________________ ____________________ ____________________ ____________________ ____________________	**Opinions** - *Include ONLY the opinions of those interviewed in the video (cite their names).* ____________________ ____________________ ____________________ ____________________ ____________________ ____________________ ____________________ ____________________ ____________________ ____________________ ____________________
Pros to Colonizing Mars - *Include only those pros mentioned in the video (not your own thoughts).* ____________________ ____________________ ____________________ ____________________ ____________________ ____________________ ____________________ ____________________ ____________________ ____________________	**Cons to Colonizing Mars** - *Include only those cons mentioned in the video (not your own thoughts).* ____________________ ____________________ ____________________ ____________________ ____________________ ____________________ ____________________ ____________________ ____________________ ____________________

Name: ____ **Date:** ________________________

Document 3: Chart: *Earth/Mars Facts and Computations Chart*

Fact	**Computation**
distance from Earth to Mars when both at aphelion (when their orbits are furthest from the sun): 401,000,000 km	1. Write this distance in proper scientific notation: _______________________________________ 2. Convert the km to miles and write the miles in standard notation. 1 mi ~ 1.6 km _______________________________________ 3. Write the miles in proper scientific notation: _______________________________________
distance from Earth to Mars when both at perihelion (when their orbits are closest to the sun): 49,000,000 km	1. Write this distance in proper scientific notation: _______________________________________ 2. Convert the km to miles and write the miles in standard notation. 1 mi ~ 1.6 km _______________________________________ 3. Write the miles in proper scientific notation: _______________________________________
Average distance from Earth to Mars in km: __________________________ _	1. Write this distance in proper scientific notation: _______________________________________ 2. Convert the km to miles and write the miles in standard notation. 1 mi ~ 1.6 km _______________________________________

	3. Write the miles in proper scientific notation: ____
Potential speed of spacecraft to travel to Mars: 32,000 km/hr	1. Using the *average* kilometers from Earth to Mars, calculate the number of hours it would take to travel to Mars. (d = rt) ____ 2. Convert the hours to number of days. ____ 3. Convert the days to number of years. ____
Cost: 6 billion dollars for the first mission, including all the hardware combined, plus the operational expenditures Each additional manned mission: 4 billion dollars	1. Write the sum of the costs of the first two missions in standard notation. ____ 2. Write the sum of the costs of the first two missions in scientific notation. ____ 3. Write a linear equation in slope-intercept form to represent the total cost (y) based on the number of missions (x). ____ 4. Graph the linear equation.

	
Mars Gravity	1. Gravity on Earth is -9.8 m/s^2. Gravity on Mars is 37% of Earth's gravity. Calculate the gravity on Mars. ____________________________________ 2. Using the formula, $h = gt^2 + vt + c$, a. Calculate the time it would take for a football to reach its maximum height if thrown at an initial speed of 20 m/s at an initial height of 3 m on Earth. ____________________________________ b. Calculate the time it would take for a football to reach its maximum height if thrown at an initial speed of 20 m/s at an initial height of 3 m on Mars. ____________________________________ 3. Impact velocity (how fast an object is going just before it hits the ground) can be calculated by the formula: $v = \sqrt{2gh}$, where g = the absolute value of gravity and h = initial height. a. Calculate the impact velocity of an object that falls from a height of 50 feet on Earth. ____________________________________ b. Calculate the impact velocity of an object that falls from a height of 50 feet on Mars.

	______________________________________
Average Temperature on Mars: -65 degrees Celsius	Using the formula: $F = \frac{9}{5}C + 32$, convert this temperature to Fahrenheit. ____
Dust Storms on Mars: - Occur once every three Mars years - top wind speeds of 60 mph - dust is very sticky, so it blocks solar panels if not removed	1. A Mars year is equal to 1.88 Earth years. In Earth years, how often do Mars dust storms occur? ____ 2. The top speeds of Category 5 hurricane winds on Earth are 157 mph. The top speeds of dust storms are what percent of the top speeds of hurricane winds? ____

Name: ____________________________________ **Date:** ___________________

Making a Decision: Buckets

To make a decision, you must first collect information to support BOTH sides in order to: a) see which side you feel most strongly about and b) see which side you have more evidence for.

YES: We should send people to Mars in the near future.

Reason #1: __________________________ ____________________________________ ____________________________________ **Documents that Support this Reason:**	**Reason #2:** __________________________ ____________________________________ ____________________________________ **Documents that Support this Reason:**

NO: We should NOT send people to Mars in the near future.

Reason #1: ______________________________ ______________________________ ______________________________ **Documents that Support this Reason:**	**Reason #2:** ______________________________ ______________________________ ______________________________ **Documents that Support this Reason:**

Name: ____ **Date:** ____________________

Decision Outline: *Should We Send People to Mars in the near future?*

**At least one of your support documents MUST be the math chart!*

Your Decision (Circle One): YES or NO

Reason #1: ____

Support from Document #____

____
__
____
__
____
__

Support from Document # ______

Support from Document # ______

Reason #2 ____
Support from Document #_____

Support from Document # ______

Support from Document # ______

Outline for Paper/Newscast:

Paragraph/Part 1: Introduce the main idea of going to Mars. Explain your opinion (yes or no) and state your two main reasons.

Paragraph/Part 2: Explain reason #1. Include support from at least two documents.

Paragraph/Part 3: Explain reason #2. Include support from at least two documents.
Paragraph/Part 4: Conclusion. Summarize your opinion and your two reasons. End with a sentence that leaves your reader thinking or questioning.

Name: __________________________ DBQ Rubric Total Score: _________ /80

	Unsatisfactory (0-3)	**Satisfactory (4-6)**	**Outstanding (7-8)**	**Score**
Document One Annotations and Guided Notes Form	Annotations and guided notes are not complete or are barely complete.	Either annotations or guided notes are complete or partially complete.	Both annotations and guided notes are fully complete.	__________/8
Document Two Guided Notes	Guided notes are not complete or are barely complete.	Guided notes are somewhat complete.	Guided notes are fully complete with relevant information.	__________/8
Document Three Computation	You answer between 0-3 of the computation questions correctly.	You answer between four and ten of the computation questions correctly.	You answer between 11-12 of the computation questions correctly.	_______ /24 0.5 points per question
Buckets	You do not not complete the bucket organizer.	You somewhat fill out the bucket organizer.	You fully complete the bucket organizer and reference all three documents.	__________/8
Decision Outline	You do not not complete the decision outline.	You somewhat fill out the decision outline.	You fully complete the decision outline and reference all three documents.	__________/8
	Unsatisfactory (0-3)	**Satisfactory (3-18)**	**Outstanding (19-24)**	
Paper or Newscast **Paper must be NEATLY WRITTEN OR TYPED and include four paragraphs.** **Newscast must be performed in front of the class, must be clear, entertaining and**	Your paper or newscast was not complete.	Your paper or newscast included some of the required elements of the four paragraphs.	Your main idea, opinion and reasons were clear. Each reason was fully supported by at least two documents (with the math included). Your conclusion included a sentence that left the reader thinking or questioning.	__________/24

include all four parts.				